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RELATIONSHIPS BETWEEN SCANNING, FIELD ARTICULATION AND SECOND ORDER PERSONALITY FACTORS

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Relationships Between Scanning, Field Articulation and Second Order Personality Factors", submitted by John J. Wine in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

ABSTRACT

Many factor analyses of personality inventories have yielded two orthogonal factors. One represents a dimension of General Adjustment and the other Introversion-Extraversion. Recently, a team of researchers headed by Riley W. Gardner have submitted evidence pointing to two orthogonal factors emerging from the responses to perceptual tasks. These have been called Scanning and Field-Articulation. Suggestions that these two pair of independent dimensions overlap prompted the present study. It was predicted that Introversion corresponded to limited Scanning and Extraversion to extensive Scanning; also that high Adjustment related to high Field-Articulation and low Adjustment to low Field-Articulation.

Two hundred and seventy-seven students from the University of Alberta were administered Cattell's Sixteen Personality Factor Questionnaire. This inventory can be scored for two second-order factors, Introversion-Extraversion and Anxiety. In this study Anxiety represented general low adjustment. Eight groups of students were selected, each group containing ten subjects of one sex who had extreme (high or low) factor scores on one dimension and middle scores on the other.

These subjects were individually administered two perceptual tests, one loading high on the Scanning factor and the other loading high on the Field-Articulation factor. It was hypothesized that factor overlap would be demonstrated by High Anxiety subjects making

higher scores (a poorer performance) on the Embedded Figures Test than Low Anxiety subjects; also that Introverted subjects would make larger overestimations than Extroverted subjects on a test of Size Estimation.

It was further expected that the independence of these orthogonal dimensions would result in finding no significant difference between Anxiety groups on the Size Estimation Test and no difference between Introversion-Extraversion groups on the Embedded Figures Test. The final hypothesis predicted that, consonant with other research, men would perform better than women on the Embedded Figures Test.

None of these hypotheses was confirmed. The negative findings were discussed in terms of the assessments being different from those used in other research, different samples of subjects and the small amount of variance accounted for in earlier studies.

An unexpected significant relationship was found between Anxiety and Scanning and this was discussed in terms of the possible difference between social and object perceptions.

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Every deadline a candidate fears was forcefully present in this effort: data collection before the end of the school term, writing before committee members were no longer available for consultation or examination and typing the final copy by the due date. Each above named person was indespensible in preventing dreaded delays.

TABLE OF CONTENTS

CHAPTER PAGE

I. INTRODUCTION 1
  Overview 1
  Background and History 3
    Personality factors 3
    Perceptual factors 10
  The Problem 30
  Hypotheses 31
II. DESIGN AND PROCEDURE 33
  Subjects 33
  Assessments 37
    Cattell's Sixteen Personality Factor Questionnaire . . . 37
    Size Estimation Test 38
    Embedded Figures Test (EFT) 41
  Statistical Design 44
III. RESULTS 46
  Independence of Assessments 46
  Embedded Figures Test 46
  Size Estimation Test 47
  Summary of Results 48
IV. DISCUSSION AND SUMMARY 58
BIBLIOGRAPHY 66
APPENDIX: RAW DATA 73

LIST OF TABLES

TABLE PAGE

I. Summary of Personality Data Before Selection for Perceptual Testing 35

II. Summary of Personality Data After Selection for Perceptual Testing 36

III. Analysis of Variance for the Embedded Figures Test: Anxiety and Sex 50

IV. Cell Means and Totals for the Embedded Figures Test: Anxiety and Sex 50

V. Analysis of Variance for the Embedded Figures Test: Introversion-Extraversion and Sex 51

VI. Cell Means and Totals for the Embedded Figures Test: Introversion-Extraversion and Sex 51

VII. Analysis of Variance for Cluster I of the Embedded Figures Test: Anxiety and Sex 52

VIII. Cell Means and Totals for Cluster I of the Embedded Figures Test: Anxiety and Sex 52

IX. Analysis of Variance for Cluster II of the Embedded Figures Test: Anxiety and Sex 53

X. Cell Means and Totals for Cluster II of the Embedded Figures Test: Anxiety and Sex 53

XI. Analysis of Variance for Cluster I of the Embedded Figures Test: Introversion-Extraversion and Sex 54

TABLE PAGE

XII. Cell Means and Totals for Cluster I of the Embedded Figures Test: Introversion-Extraversion and Sex 54

XIII. Analysis of Variance for Cluster II of the Embedded Figures Test: Introversion-Extraversion and Sex 55

XIV. Cell Means and Totals for Cluster II of the Embedded Figures Test: Introversion-Extraversion and Sex 55

XV. Analysis of Variance for the Size Estimation Errors: Introversion-Extraversion and Sex 56

XVI. Cell Means and Totals for the Size Estimation Errors: Introversion-Extraversion and Sex 56

XVII. Analysis of Variance for the Size Estimation Errors: Anxiety and Sex 57

XVIII. Cell Means and Totals for the Size Estimation Errors: Anxiety and Sex 57

LIST OF FIGURES

FIGURE PAGE

1. Statistical Design of the Study 45

CHAPTER I

INTRODUCTION

Overview

This study concerns the possible relationship between personality factors and perceptual factors. The overall format of this section will be first introducing the reader to the general concepts on which the research is based, and then turn to a detailed review of pertinent research and theory in the component areas of personality and perception. Relationships between these areas of research will be shown to suggest specific hypotheses, the testing of which comprises the body of this work.

"Personality factors" and "perceptual factors" are terms used here in the literal,factor-analytic, sense, as this study was suggested by and makes use of metric devices based on factor-analyses. It now appears that whenever a large pool of responses to personality questionnaire items are subjected to this kind of analysis, quite predictable results emerge. One factor, usually the first, appears to represent a general dimension of "Adjustment-Maladjustment". Such labels as "Neuroticism", "Anxiety" and "Ego-Strength" have been suggested. Another factor, usually interpreted "Introversion-Extraversion", after Jungian typologies, is most often the second to emerge. Although third, fourth and more factors are sometimes extracted, some measure of "Maladjustment" and "Introversion" consistently account for

a large portion of total personality test variance.

If we begin with Thurstone's effort in 1944, factor-analytic work in perception is as old but certainly not as extensive as that in personality. Thus, we do not have so firm a position from which to make definitive statements about "factors" in perceptual skills. Nevertheless, the research team headed by Riley Gardner has, in the past several years, produced a prodigious amount of perceptual data, including a number of factor analyses. Another team, working with H. A. Witkin, though not oriented toward factor-analysis, has provided abundant research making use of a number of perceptual tasks loading on perceptual factors.

Interestingly, the number of factors extracted from performance measures on perceptual tasks has numbered about the same as personality factors, and only two have been generally considered to have broad explanatory or correlational potential. Gardner speaks of these factors as "cognitive control principles" and they have been labeled by him as the principles of "Scanning" and "Field-Articulation". They are both considered elements or properties of attention habits and have been shown to represent consistent perceptual differences between individuals.

The Scanning principle refers to the degree to which an individual scans or gives cursory attention to environmental stimuli. Field-Articulation is attention given to selective, or partial aspects of the total stimulation, including relationships between aspects.

Thus, Scanning is generally the quantity of stimuli observed and Articulation is the selective observation of relational features among the stimuli.

Studies to be discussed demonstrate a relationship between a perceptual test which loads on Gardner's Scanning factor and the personality dimension of Extraversion. Other studies demonstrate a correlation between a perceptual test loading Gardner's Field-Articulation factor and Anxiety. Together, these studies suggest that the two, independent personality factors and the two, independent perceptual factors might share common cognitive sources so that the degree of Introversion is related to the degree of Scanning in the same individual; and similarly, that the degree of maladjustment, or anxiety is related to the degree of Field-Articulation. Since the two personality factors are orthogonal or independent, and the same is true of the two perceptual factors, it could be further hypothesized that Scanning is unrelated to "maladjustment" and that the Field-Articulation is unrelated to Introversion-Extraversion. Answering these questions is the overall purpose of the research to be reported.

Background and History

Personality Factors

Now, we will turn to research which has preceeded and suggested this study. First let us look at factor work in personality and some theoretical issues which arise. Introversion-Extraversion and some

form of general maladjustment have appeared as important personality dimensions with remarkable consistency. Eysenck has provided perhaps the most thorough review of research, which has sought to identify important personality factors. He comments (1960, pp. 425-26) that remaining disagreements appear due to either a) beginning with too few variables, b) analysis not carried out to conclusion (or before the principle of oblique and second-order factors was established) or c) differences in aim. In his book, the reader is first told how this conception predates metric devices in the Galen-Kant-Wundt system of personality description, (pp. 17-18). Thinking of "quick vs. slow" and "weak, non-emotional vs. strong, emotional" as two independent but continuous personality dimensions, the resulting four quadrants may represent the sanguine (quick, weak), phlegmatic (slow, weak), choleric (quick, strong) and melancholic (slow, strong) personality types. Of course, translating these into continuous variables is Eysenck's addition to demonstrate that earlier discrete categories were simply beginnings of later conceptualizations which allowed "in-between" individuals to be charted, ("the transfer of interest from quadrants to coordinates"). Eysenck then gives credit to Jung for his very similar conceptualization, and quotes Jung's statement "it is a mistake to believe that introversion is more or less the same as neurosis. As concepts, the two have not the slightest connection with each other". (Eysenck, 1960, p. 25).

Let us turn now to the technique of factor analysis and the

model it offers for our understanding of personality structure. To refer to an often cited reference, again by Eysenck (1947), it is explained that factor analysis organizes our data into different levels of synthesis.

> "We are dealing with four levels of behaviour organization. At the lowest level, we have specific responses...These are acts, such as responses to an experimental test or to experiences of everyday life, which are observed once, and may or may not be characteristic of the individual. At the second level, we have what are called habitual responses...These are specific responses which tend to recur under similar circumstances; i.e. if the test is repeated, a similar response is given, or if the life-situation recurs, the individual reacts, in a similar fashion. This is the lowest level of organization; roughly speaking, the amount of organization present here can be measured in terms of reliability coefficients, i.e. in terms of the probability that on repetition of a situation behaviour will be consistent.
>
> At the third level, we have organizations of habitual acts into traits...These traits--irritability, persistence, rigidity, etc.--are theoretical constructs, based on observed intercorrelations of a number of different habitual responses; in the language of the factor analyst, they may be conceived of as group factors.
>
> At the fourth level, we have organization of traits into a general type; in our example, the introvert. This organization also is based on observed correlations, this time on correlations between the various traits which between them make the concept of the type under discussion. Thus in our example, persistence, rigidity, subjectivity, shyness, irritability, and various other traits would form a constellation of traits intercorrelating among themselves, thus giving rise to a higher-order construct, the type." (pp. 28-30).

The use of words "trait" and "type", conveys the author's feeling that the technique of factor analysis may be equally useful for the "specificists" and "generalists", for the "behaviorists" and "cognitive theorists". If the researcher's predilection is for groups of consistent behavioral acts, group factors may be obtained and reported.

If it is for the more general description of the "cognitions" or personality "types", second-order factors may be obtained from first order. It will be apparent that second-order factoring permits a comparison between the results of immediate orthogonal analyses and those of oblique group factoring which may yield correlated dimensions. Second-order factors are obtained by an orthogonal analysis of oblique factors and in the case of personality dimension, give results highly similar to those obtained by initial orthogonal analysis. This will become clear later.

Perhaps the earliest of personality questionnaires which still has wide current acceptance is the Minnesota Multiphasic Personality Inventory (hereafter referred to as the MMPI). Individual scales on this test were empirically derived for their ability to reliably differentiate persons in various diagnostic categories from normals. Later research demonstrated the utility in examining groups of scales for characteristic patterning, revealing that persons of certain "types" or with particular "problems" tend to score on a number of scales in a similar fashion. This kind of "pattern" use of the MMPI has been considered useful for identifying problems of people in the "normal range" as well as for hospitalized patients or more severe clinical sub-groups. Even larger portions of the MMPI come under consideration when the scores on this test are subjected to factor analysis. This might be expected since factor analysis is designed to explain test scores in the smallest number of meaningful factors.

However, it might be unexpected that only two factors are consistently extracted to account for a very large portion of the total test variance. An article by Welsh (1956) comments on the similarity of eight independent factor analyses of MMPI scores:

> "In almost all the studies there is essential agreement as to the loadings of two factors although the interpretations and the name assigned to these factors vary. One factor (usually the first) shows very high loadings on scale 7 (Pt) and scale 8 (Sc) with negative loadings on K whenever it is used. A second factor shows fairly high loadings on the neurotic triad, especially scale 3 (Hy) and scale 2 (D), with negative loading frequently appearing on scale 9 (Ma).
>
> Unpublished factor studies have been carried out by the present writer on three different populations...All three studies confirm very clearly the factor loading patterns outlined above.
>
> The remarkable similarity of loadings on these two factors has appeared despite the varying populations employed." (p. 264).

The first factor referred to in the quotation above is invariably interpreted in words referring to "General Maladjustment". Researchers most frequently refer to this factor as "Neuroticism" or "Anxiety". The second is "Introversion". Let us look at the findings of some individual investigators. One study is by Kassebaum, Couch and Slater (1959). To the 13 MMPI clinical and validity scales, the 160 tests were also scored for 19 other, nonclinical scales, and the resulting correlations between the entire 32 scales were factor-analyzed by Thurstone's centroid method. Again, two factors accounted for almost all of the variance. These they called "ego-weakness vs. ego-strength" and "introversion vs. extraversion".

Kassebaum, et. al. (1959, p. 234) make reference to the

apparent relationship between the number of scales included in earlier MMPI factor analyses and the similarity of findings to their own. As more dimensions are simultaneously examined, there seems to be greater assurance that these two factor constructs will be descriptive of the overall questionnaire-response.*

Not only number of scales but breadth of study by a single investigator seems related to two-dimensional factor findings. H. J. Eysenck and R. B. Cattell stand out as notable investigators in personality factor research. Eysenck (1959 and Eysenck and Eysenck 1964) constructed first the Maudsley Personality Inventory (MPI) and later the Eysenck Personality Inventory (EPI), which are based on literally tens of thousands of cases and dozens of factor-analyses. Eysenck, as mentioned above, finds repeated evidence in his own work and in that of others, to support the two-dimensional view of personality. The tests, and the EPI is simply a refinement and extension of the MPI, are designed to yield Extraversion and Neuroticism scores representing the strength of the test taker's respective personality dimension or type.

R. B. Cattell's "Sixteen Personality Factor Questionnaire" was based on similarly rigorous factor-analytic methodology. The test,

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*The extensive factor analytic work of Comrey (1957a, 1957b, 1958a, 1958b, 1958c, 1958d, 1958e, Comrey and Marggraff 1958, Comrey and Soufi 1960) with single MMPI scales is of interest in that almost every scale was found to contain one factor labeled "shyness", "withdrawal" or "anti-social behavior" and another factor termed "neuroticism" or "poor physical health".

however, assigns scores to fifteen oblique personality factor dimensions plus a factor of verbal intelligence. The personality dimensions represent consistent factor findings from repeated examination of many groups of individuals (Cattell and Stice 1957). Although Cattell's theoretical emphasis has been to stress the importance of group factors on the basis of a more meaningful description of the individual, he has re-factored these dimensions for second-order, or type descriptions. His manual for the "16 P. F. Test" (1957) presents simple scoring instructions for close estimations of these second-order factor scores. These second-order factors are called "Anxiety" and "Introversion-Extraversion".

Perhaps mention should be made of the difference between labels given to the second-order "maladjustment" factor by Eysenck (Neuroticism) and Cattell (Anxiety). Cattell feels quite strongly that his second order factor is a measure of anxiety on the basis that it correlates quite highly with an independently labeled anxiety factor (1956, p. 416) and much lower with a factor found to differentiate neurotics from normals (1956, p. 416 and 1961, pp. 456-460). Nevertheless, he admits (1956, p. 416) that the first second-order factor "has clearly brought together the 'pathological' primaries" of the 16 P. F. Test. Eysenck comments (1964, p. 6) that Cattell's scheme "has been found to give rise to essentially very similar results". To the writer's knowledge, Eysenck is the only one to report a correlation between his "maladjustment factor" and that of Cattell's. In his

manual for the MPI (1959, p.4) he reports correlations of .67 and .65 between his factor scales (long-form of the MPI) and the introversion and "neuroticism" scales respectively of Cattell's second-order factoring. Differences in terminology and interpretation need not concern us here. It is important however, that many researchers, by independent analyses, have found that whenever a large number of personality dimensions are processed for second-order factors, some expression of General Maladjustment and of Introversion-Extraversion invariably appears.* By all indications, the emerging factors are highly similar in content and meaning. But certainly the consistency of method and findings is more important to this discussion than the interpretation of factors.

Finally, an early study will represent a factor analysis of many of Guilford's scales. Lovell (1945) obtained six "super-factors". The first is called Drive Restraint and bears a close resemblance to Introversion. The second is Realism and appears to reflect general mental health.

Perception Factors

It may be of interest to the reader to begin this section by first quoting from Bruner and Postman who in 1949 distinguished between camps of perceptual theorists whom they called "formalist" and "functionalists". The former was seen by these authors as being

---

*French (1953) provides an excellent summary of factor-analytic work in personality measurement but does not give specific attention to second-order factoring.

interested in stimulus properties in and of themselves and the latter interested in "central conditions" or perception as it related to motives, predispositions and past learnings. The authors were and are decidedly of the latter persuasion but feared then that:

> "...perhaps ten years hence there will appear in some prominent psychological periodical an article entitled 'There Are Six Kinds of Perception'." (1949, p. 30).

They added that "such multiplicity is preferable to a schizoid separation between perception on the one hand and everything else on the other". Exactly a decade later, as prognosticated, a research team headed by Gardner (Gardner, et. al. 1959) published a monograph entitled "Cognitive Controls" in which they reported a factor analysis of performance on 33 perceptual tests yielding exactly six factors for women, five for men. A year later a second monograph (Gardner et. al. 1960) reinforced this conceptualization.

Much work had preceeded these publications by Gardner and his research team and some of the perceptual factors were previously isolated. However, this is the first recent (Thurstone, 1944, factor analyzed scores on a large number of perceptual tests) attempt to factor performance on a large variety of perceptual tests in a single analysis.

The emerging factors were labeled "cognitive controls" or "cognitive control principles" to represent what the authors feel are consistent individual differences underlying approaches to perceptual tasks. From this monograph, (1959, pp. 5-6) we learn that:

> "Cognitive controls are conceived of as slow-changing, developmentally stabilized structures: (a) they are relatively invariant over a given class of situations and intentions; (b) they are operative despite the shifts in situational and behavioral contexts typical of cognitive activity from moment to moment. Cognitive controls refer to a level of organization that is more general than the specific structural components underlying perception, recall, and judgment. The invariant which defines a control has to do with the manner of coordination between a class of adaptive intentions and a class of environmental situations. They are the individual's means of programming the properties, relations, and constraints of events and objects in such a way as to provide an adaptively adequate resolution of the intentions which brought him into an encounter with reality." (pp. 5-6).

Men's scores and women's scores were analyzed separately to allow sex differences to emerge. And emerge they did. These differences will be discussed in more detail later but our emphasis now will be on the nature of the cognitive controls found. Factor extraction was by the centroid method for men with orthogonal rotation and by the multiple group method with orthogonal rotation for women. Grouping was based on a previous centroid analysis. Thus the cognitive controls described are thought to be independent of one another. Five important factors are discussed.

(1) One factor is called the Leveling-Sharpening Control and pertains to differentiation in memory organization. High factor scores (levelers) showed relatively simple, undifferentiated memory organizations. Low scorers (sharpeners) were able to maintain discrete impressions and memories of successive stimuli.

(2) Another factor is labeled Equivalence Range. High scorers showed relatively relaxed and inclusive criteria of similarity. Low scorers showed more exacting criteria of similarity. Pettigrew (1958)

developed a Category Width scale showing that narrow categorizers (low Equivalence Range) were willing to check fewer adjectives as being self-descriptive than broad categorizers. This is seen as a highly stable characteristic of individuals. Fillenbaum (1959) found this factor unrelated to I. Q. and MMPI personality scales.

(3) Gardner says a third factor "appears to represent the principle of Tolerance for Unrealistic Experiences and represents modes of organizing behavior in respect to experiences that violate the normal assumptions of reality" (Gardner, 1959, p. 89). High scorers tended to organize more quickly experiences (looking through aniseikonic lenses) that were inconsistent with their knowledge of reality. Low scorers were hampered by attempting to organize in terms of experiences that conformed to conventional reality. These differences seem to be accentuated by threat conditions (Schwab & Iverson, 1964). This principle has received close examination by Klein, et. al. (1962).

Because the last two factors have been given a great deal more attention in subsequent research and because they have particular relevance to the present study, they will be given greater coverage here. They are, respectively, the control principles of Scanning and Field-Articulation.

(4) The Scanning Control Principle represents the degree to which an individual scans or samples from the total available stimuli in his environmental field. High factor scorers scan their environment extensively. Low scorers are limited scanners.

The extent or extensiveness of Scanning has certain effects on perception, particularly on the accuracy of visual judgments. Thus, the tests of visual constancy and size estimations have become the most widely used measure of this factor. High scorers on this factor are more accurate on these tasks than low scorers. Specifically, when instructed, they are able to report more accurately the actual size or shape regardless of differences in slant, distance, etc. A standard and a variable stimuli are used in size-estimation tasks and the subject is required to match the variables with the standard. In various studies these stimuli have been either the same or different distances from the observer's eyes. Either procedure yields essentially the same results. Accuracy scores may be of two kinds: 1) absolute size of the variable stimulus after the subject has attempted to match it with the standard, or 2) error, i.e. difference between judged size and size of standard. It happens that these are virtually the same in practice since the great majority of subjects make overestimations. For a theoretical explanation of Scanning, Gardner and his team of researchers turn to Piaget's "centration hypothesis". (Piaget, 1961; Piaget, et. al. 1958). The overall notion is that those stimuli or areas of a stimulus pattern which receive the observers "central" attention are overestimated in size, while those more peripheral aspects are underestimated. More specifically, five laws or principles appear to govern size distortions (Piaget, 1961, pp. 100-115):

1) Foveal stimulation results in overestimation; peripheral

stimulation will yield underestimation.

2) Overestimation increases with the duration of a single fixation, or centration, up to a certain optimal duration after which there is no change.

3) In a temporal order of succession, the latter stimuli are relatively overestimated.

4) More intense attention results in greater overestimation.

5) Overestimation is greater with increasing distinctness of the stimuli (clarity, distance, etc.)

In the same section, he describes variables important to procedures used for estimating size. Since a variable stimulus is manipulated (usually by the subject) to match a standard stimulus, the above principles are not sufficient to explain errors in matching two stimuli which are both viewed by the subject. Additional rules which apply to this procedure are as follows:

a) The stimulus or element chosen as a standard is overestimated.

b) Overestimation may not occur if the discrimination is a very fine one.

c) When both stimuli are a short distance apart and simultaneously in view, the variable stimulus is overestimated (opposite of principle a).

Piaget reasons that when both stimuli are in the same stimulus field, they form a single configuration and under these conditions the subject is likely to centrate on the variable. He speaks of one

stimulus having a "privileged role". This would appear to be the role of the standard when the stimuli are presented singly and the role of the variable when presented together. The stimulus in the "privileged role" received a greater proportion of centrations. Gardner and Long (1962b) tested these theoretical ideas by photographing subject's eye movements while making size estimations. He recorded the number of centrations on standard, time spent on standard, percentage of time on standard, time per centration on standard in addition to time to make a judgment, etc. Conclusions drawn were: 1) people differ consistently in scanning strategies, 2) centrations correlate with constant errors, 3) apparent size is a function of duration of single centration (errors were smaller with lengthened duration) and 4) extreme Scanners make relatively small overestimations. These centration measures pertained to the standard stimulus and Piagets' theoretical formulations were upheld.

Since additional support for the centration hypothesis has been gained from much work with visual illusions, it will be mentioned in passing here. A number of studies (Gardner, 1961; Gardner and Long, 1960a, 1960b; Piaget, 1961; Piaget, et. al. 1958) generally point to the following conclusions:

1) Illusions appear as illusions because the area of a figure given focal attention is seen as larger (overestimated) with respect to more peripheral regions which are underestimated.

2) Overcoming an illusion is performed more quickly by extensive scanners when it is helpful to see some portion of the figure in relation to other portions.
3) Illusions calling for more focal attention or differentiating one aspect from another is felt to bring another control principle into play. This principle is Field-Articulation and is discussed below.

With respect to personality, we get a picture of high Scanners as extraverted, exacting and suspicious. Following are quotations giving investigators' impressions:

> "The extensive scanner seems preoccupied with the veridicality, exactness and acceptability of his response. The limited scanner seems to accept his perceptual experience in a more relaxed and less critical way." (Gardner and Long, 1962, p. 139).
>
> "The dominant impression was 'one of intense intellectualizing tendencies, pervasive experiences of ambivalence, mistrust, expectation of being hurt. They regarded the world as a source of malevolence and danger, and had a generally pessimistic outlook on the present and the future. They seemed preoccupied with issues of mastery, and they were intensely self-absorbed (e.g. they made an unusually large number of references to body parts on the Rorschach). They felt guilty, dissatisfied with their achievements and their contacts with objects and people and objects were darkened by aggression. At the same time they were intensely absorbed in the rejecting and threatening world of people and things." (Klein, 1958, pp. 111-112).
>
> "The scanner is aware of a broad array of background qualities of a stimulus field. His investment is intensely incorporative, characterized by a constant close look." (Klein, 1958, p. 109).

We are told that extensive scanners are more likely to use the defences of isolation and projection as detected in certain Rorschach indices. (Gardner, 1962).

Although this study is not directly concerned with sub-groups within schizophrenia, an article by Silverman (1964) discusses the usefulness of cognitive controls in differentiating one sub-group from another. Based on size-estimation tasks and tests of perceptual constancy, paranoid schizophrenics tend to be extensive Scanners and non-paranoid schizophrenics limited Scanners. Further, both extremely extensive and extremely limited scanning are poor prognostic indicators for all schizophrenics.

Studies of need-perception relationships, such as carried out by Bruner and Postman, will not be discussed here since the present study is concerned with individual perceptual consistencies rather than perceptual variations. It may well be that object value influences such a perceptual habit as Scanning but this goes beyond our interest in the effects of Scanning in and of itself.

Of direct relevance to the present research are three studies concerned with the relationship between perceptual constancy (Scanning) and Introversion-Extraversion. First, an early article by Thouless (1932) reported perceptual constancy performances of introverted or "schizothymic" individuals and extraverted or "cyclothymic" individuals. These subjects were selected on the basis of Kretchmer's descriptions. He found greater constancy in extraverted subjects and attributed this to the relative interest of introverts in their own subjective world. Other findings were greater constancy with increasing age, among men, and among the more intelligent. Only the difference in age was clearly significant.

Weber (1939) tested only female sophomores with extreme scores on Guilford's factor of social introversion and found extraverts showing greater size constancy, but not greater form constancy than introverts. Ardis and Fraser (1957) referred to Weber's failure to find significant differences between groups on form (shape) constancy. They selected subjects on the basis of another of Guilford's introversion factors (Thinking Introversion) and found extraverts to show greater constancy at a high level of significance. Having tested both men and women they were also able to find that men tended (p. 10) to show greater constancy than women. There were no interaction effects. They commented that their introverts were more introverted (lower scores) than Weber's sample of American sophomores.

Recalling that perceptual constancy loads highly on Gardner's Scanning dimension, we have some confirmation that a relationship exists between this perceptual factor and the personality factor of Introversion-Extraversion. However, Gardner, et. al. (1959, p. 114) reports that error scores on a task of Size Estimation is the only measure "placed unequivocally in that factor (Scanning) on both empirical and theoretical grounds", so we might expect an even greater relationship between Size Estimation and Introversion-Extraversion. The present study tests this hypothesis.

(5) Field-Articulation is the final cognitive control principle extracted by Gardner, et. al. (1959) from performance scores on perceptual tests. It emerged from the factoring of women's scores

only. Again, sex differences will be described at a later time. In this monograph high factor scorers (low Field-Articulators) are described as those who "tended to organize fields containing stimulus incongruities along the simplest possible lines." (p. 94). This means that if asked to respond selectively to only relevant cues that are within fields containing irrelevant cues also, they have difficulty by virtue of attending to the most compelling aspects or elements, while ignoring others. Conversely, low scorers or high Articulators are able to confine their attention to those elements required by instructions and resist responding to contradictory or irrelevant elements.

This construct might be said to have had its origin in the development of two other concepts which have since been theoretically linked to Field-Articulation. The first of these was described by Klein (1954) and is thought to represent the degree of individual constriction or flexibility in shifting sets. The test which Klein used as a measure of Constriction-Flexibility is the Stroop Color-Word Test requiring the subject to report from a list of color names, not the words printed, but the color in which each name is printed. Thus, if the word "blue" is printed in a red color, the subject is to report "red". The speed with which a person can report the requested information is said to be an indicator of his "flexibility" with respect to adopting an unfamiliar set when other stimuli may evoke a more familiar set. A "flexible" individual, by virtue of being able to disregard interfering information, is able to read a list of such words more

quickly than a "constricted" individual who is unable to effectively gait out the interference.

Studies by Witkin and his team of researchers (Witkin, 1949, 1959; Witkin, et. al. 1954, 1962) have focused on a concept they call Psychological Differentiation. In their framework, individuals are seen as having more dependent or independent orientations to their environmental fields. The following quotation demonstrates that this group of researchers see their construct as encompassing cognitive-intellectual functioning as well as perception.

> "A tendency toward an analytical or global way of experiencing characterizes a person's problem-solving activities as well as his perception. We have adopted the term "analytical field approach" for the style of functioning represented in both the perceptual and intellectual behavior of an individual, which involves the ready ability to overcome an embedding context and to experience items as discrete from the field in which they are contained. The term "global field approach" has been suggested to describe the style of functioning that involves submission to the dominant organization of the field and the tendency to experience items as "fused" with their background. Field-dependence-independence represents the perceptual component of this broader dimension." (Witkin, et. al. 1962, p. 80).

Tests for Witkin's Field-dependence-independence are chiefly three: One of these is the Rod and Frame Test. The subject is required to sit in a completely darkened room and is presented with a tilted square frame which surrounds a long rod. The rod and frame are luminescent. While the frame remains in its tilted position the subject is allowed to control the tilt of the rod and is asked to bring it to an exactly upright position. Some subjects are reliably better able than others in approximating a true vertical position. Those who are more accurate are said to be better able to selectively attend to relevant stimuli

and are called Field-independent. The less accurate appear unable to truly differentiate between relevant and distracting stimuli and are classified more Field-dependent.

A second test is similar in that a field is tilted and an upright is sought. This is the Tilting-Room-Tilting-Chair arrangement. The subject sits in a tilted chair and is surrounded by a room which is also tilted. The subject uses controls attempting to bring himself and the chair into a true upright position. As in the Rod and Frame test, this distributes subjects along a continuum of Field-dependence and independence, and a high correlation exists between the performance scores on the two tests.

A third measure used by this research team is Witkin's Embedded Figures Test (Witkin, 1950). Witkin adapted a selection of the Gottschaldt figures to make them more difficult by adding color to twenty-three of the designs. One other of the figures is retained in its original uncolored form. The subject is first presented with a complex figure for fifteen seconds. This is removed and he is shown a simple figure which is contained in the larger design. When the simple figure is removed, the complex is presented again and the subject's score is the time taken to recognize where the simple figure appears in the complex. It is thought that faster performers are better able to selectively attend to relevant stimuli embedded in irrelevant or distracting stimuli. Performance on this test too, is highly correlated with that on the Rod and Frame Test and in the Tilting-Room-Chair arrangement.

Gardner (e.g. 1962) views both Witkin's dimension of Field-dependence-independence and Klein's "Flexibility" as "the capacity to attend and respond selectively to relevant (vs. irrelevant) cues". (p. 193). Similarly, performance on the Stroops Color-Word-Test is tentatively seen as selectively responding to relevant cues in the presence of interfering information. All of the above named tests yield performances which load on Gardner's Field-Articulation factor. Gardner's factor analytic work did not include the Tilting-Room-Tilting-Chair but we have assurance from Witkin's work that correlations with these other tests are high and on this basis could suppose that it, too, represents a test of this independence or Articulation dimension.

Witkin tends to see the dimension as being relatively restricted to attending to relevant stimuli embedded in a larger context. Gardner answers persuasively with (1) the factor analytic work described, (2) a demonstration that EFT performance is related to recall and recognition of words under conditions of interference (Gardner and Long, 1961) and (3) showing that low EFT scorers are superior in selectively attending to either surrounding stimuli or embedded stimuli (Gardner, 1962).

Let us now turn to studies which throw light on the nature of this dimension. Linton (1955) found, in keeping with the face meaning of dependent-independent, that the relatively more field-dependent experienced more movement in an experiment of autokinesis. She also

found that the more dependent exhibited a greater change in attitude after reading an article of an authoritative nature.

Wertheim and Mednick (1958) found that field-dependence was positively related (p. 61) to need-achievement. That is, greater need-achievement was associated with greater field-independence.

Block (1957) separated two groups on the basis of greater and lesser GSR responsiveness. The Rod and Frame test was found to distinguish these groups at a significant level. The author describes the "reactors" (dependent) as being relatively cautious, dependent, dreamy, idealistic, mannerly, and suggestible. The "non-reactors" were more clever, cool, evasive, independent, ingenious, leisurely, opportunistic, practical, and realistic.

Holtsman criticizes Witkin's research for not giving careful attention to issues of validity and reliability. This prompted Young (1959) to repeat his work in miniature by employing many of the measures and introducing more rigorous controls by carefully testing for inter-judge reliability with respect to personality ratings, etc. His conclusions are: 1) all the perceptual tests do indeed appear to measure a single factor based on high inter-correlations. 2) For men, self attitudes of passivity, dependence, distrust of one's own feelings and bodily experience, as revealed in figure drawings, are related to Field-dependent perceptual performances. 3) Lack of effectiveness in coping with environmental demands related to Field-dependent perceptual performance. This relationship was stronger for women than for men.

4) Neither self-concept variables nor the discrepancy scores between self-concept and self-ideal related to perceptual performance.

Rudin and Stagner (1958) used the semantic differential procedure and found that the relatively more dependent individuals differed more in their self-concept when in different social situations. Again, this adds a kind of face validity to the label "dependent-independent" in that the subjects who would "depend" more on the surrounding visual field in tests of perception were also those to depend more on the social context for the concept of their own role.

These and other personality characteristics associated with the Field-dependence-independence or Field-Articulation principle are of primary importance to the study to be described. It has already been mentioned above that the more dependent or less articulate are characteristically more cautious, dreamy, suggestible, with attitudes of passivity, distrust, and lack effective coping behavior for environmental demands. Witkin, et. al. (1962, pp. 165-69) discuss other studies describing characteristic differences between the dependent and more independent individuals. He adds these descriptions from unpublished manuscripts or articles with limited circulation: verbally expressed fears and aversions which "may be interpreted as open expressions of anxiety" (p. 168), confused, disorganized, unadaptive under stress, self-indulgent--all describing more dependent Air Force captains. In another section he reviews studies pointing to dependent individuals as likely to be ulcer patients, obese people,

asthmatic children or alcoholics. It is concluded that "The results of this group of studies suggest that persons with a relatively global field approach are more apt than analytical people to show open anxiety reflecting, presumably, less effective controls."

Although all of this is highly suggestive, to the writer's knowledge there exists only one study which directly relates a measure of anxiety to a test loading highly on Gardner's Field-Articulation factor. In this study, Weiss and Sherman (1961) found that the Stroop's Color-Word Test was significantly correlated with McReynold's test for anxiety in a sample of 80 college students. The direction of the correlation associates high Anxiety with low Articulation. Another study (Taft and Coventry, 1958) failed to find a relationship between neuroticism and Field-dependence but Witkin answers (Witkin, et. al. 1962, p. 205) that their method of rod manipulation without a surrounding frame is not a true test of Field-dependency.

Field-independence does appear related to certain tests of intelligence. Jackson (1957) found his short form of the Embedded Figures Test (Jackson, 1956) significantly correlated with the ACE among college students. Goodenough and Karp (1961) investigated this relationship further, using younger children as subjects. They factor analyzed scores on the WISC, Rod and Frame Test, Embedded Figures Test and the Tilting-Room-Tilting-Chair. Loading on the Field-dependence factor were the subtests Block Design, Picture Completion and Object Assembly. It appears that only performance measures, and perhaps only

performance tests requiring the correct assembly of parts, are related to the Field-dependence dimension.

It is now fairly well established that Field-independence or Articulation develops with age. Witkin, et. al. (1954) has given a great deal of attention to the developmental patterns of Field-dependence and concludes (Witkin, 1959) that there is marked improvement in skill on tests of Field-independence between the ages of 8 and 13 with relative stability after the age of 17. Later in life, there may be a slight tendency to regress. This finding will not surprise those familiar with the efforts of Piaget (especially 1952) to describe the development of children progressing from less to more specific and integrated attention patterns. Finally, there is normative data showing that women are relatively Field-dependent compared to men (Witkin, 1950). Bieri, et al. (1958) conclude that men do better on the EFT because of greater aptitude for mathematics plus a better "conceptual" approach to social and objective stimuli.

Before leaving this section, we might again mention the similarity of the concepts offered by the research teams headed by Witkin and Gardner. It is not intended here to select one interpretation over the other but rather to point out that with respect to factor structure, tests such as the Rod and Frame Test and the Embedded Figures Test seem to define an important perceptual dimension. This being said we do give credit to Gardner for demonstrating the apparent independence of this dimension from other perceptual "controls".

Hereafter his terminology will be adopted for reference to this and other perceptual factors.

Two important issues remain: 1) Which of the described factors have been shown to have important relationships to personality? and 2) Can these factors be said to be represented in both sexes?

Certainly Gardner's factors called Scanning and Field-Articulation have thus far proven to offer the most with respect to personality structure. Gardner (1961) referring to earlier work (Gardner, et. al. 1959) says:

> "Results of this study suggest that at least two of the control principles apparent in subjects' performance in laboratory and clinical tests may have particular relevance to attention and attention deployment in adaptive behavior." "Both principles are relevant to situations in which the subject must attend a) to stimuli outside himself or b) to elements of memory schemata within himself." (p. 120)

Silverman (1964) finds the two control principles particularly meaningful in differentiating sub-groups of schizophrenics. Generally, he finds the paranoid schizophrenic patients to be extensive Scanners and high Field-Articulators. Other sub-groups are associated with limited Scanning and Articulation. It is difficult to interpret the meaning of Silverman's work for possible implications about relatively normal individuals but it is nevertheless interesting to note that he found the two concepts to be associated with different personality categories.

Before presenting the problem to be studied here we must finally look at the relevance each of these control principles holds for both sexes. The issue arises from the fact that Gardner found the Scanning

factor arising only from men's scores and the Field-Articulation only from the women's scores. There are, nevertheless, definite suggestions that each of these dimensions pertains to both sexes. First, a number of studies have examined one or the other of the principles finding them equally descriptive of both males and females. Further, no study reported in this paper or encountered by the writer has reported interaction effects between sex and performance. With respect to this body of evidence, Gardner, et. al. (1959, p. 110) says of his factor analytic results:

> "The striking sex differences in results of the factor analyses for the present small samples of men and women require interpretation. On the basis of previous results, it seems safest to assume that these differences are more apparent than real. Gross sex differences were not apparent in previous studies of five of the cognitive controls. The study of field dependence-independence by Witkin, et. al., in which sex differences were explored more adequately, showed greater consistency in men than in women, in direct contrast to the present results. Further studies with larger and better-controlled samples of each sex are needed to explore the possibility that men and women are in fact characterized by different control principles and different relationships among control principles."

Gardner later makes reference to this statement after finding, in a subsequent study, that both Scanning and Articulation emerge as factors to explain differential performance on a test of illusions with only one sex (Gardner, 1961).

> "The present study thus seems to confirm the anticipation that both principles can be demonstrated for one sex if a larger group of subjects and more effective tests of Scanning are employed." (p. 126)

It is therefore believed that both Scanning and Field-Articulation represent controls used by both sexes, though different levels of

proficiency on the representing tests are recognized. That is, men are generally better performers on tests of Field-Articulation.

The Problem

We have seen that when examining either personality or perception in terms of the factor structure of test scores, primary attention has been given to two of the factor dimensions. For personality, these dimensions have been General Maladjustment and Introversion-Extraversion; for perception, Scanning and Field-Articulation. Additionally, a number of studies have been reviewed which definitely suggest relationships between the personality and perceptual factors such that a) high Maladjustment is associated with low Field-Articulation, b) low Maladjustment with high Field-Articulation, c) high Introversion is associated with low Scanning and d) low Introversion (Extraversion) with high Scanning.

In view of these suggested relationships, we would expect that they might be confirmed by an analysis of personality factor scores and test scores considered most representative of the perceptual factors. This is the precise purpose of the present study. In keeping with the factor approach to personality, subjects might be selected on the basis of a factorally determined instrument of personality assessment that can be scored for second-order dimensions. Cattell's Sixteen Personality Factor Questionnaire (Cattell and Stice, 1957), is just such a measure and was used in the research to be reported.

Perceptual tests should be the best possible representatives of the Scanning and Field-Articulation factors. In the present instance, selection was guided by Gardner, et. al. (1959). From this work, the following statements directed the choice of instruments:

> "SCANNING. The error score for Size Estimation....was the only one of the three experimental measures with very high loadings on Factor I for men that was placed unequivocally in that factor on both empirical and theoretical grounds."
>
> "FIELD-ARTICULATION. The Embedded Figures and Rod and Frame Tests provide clear measures of this control principle...." (p. 114)

Thus, a Size-Estimation task very similar to Gardner's was used as a measure of the Scanning factor and the Embedded Figures Test as a measure of Field-Articulation.

Hypotheses

The study is designed to test the following hypothesized relationships between perception and personality:

1) A group of subjects with High Anxiety factor scores will have longer response times (make higher scores) than a group with Low Anxiety factor scores to items on the Embedded Figures Test.
2) A group of subjects with High Introversion-Extraversion factor scores will make larger errors than a group of subjects with low factor scores on a test of Size Estimation.
3) There will be no significant difference between Anxiety groups on the Size Estimation test.
4) There will be no significant differences between Introversion-

Extraversion groups on the Embedded Figures Test.

5) Men will make lower scores than women on the Embedded Figures Test.

CHAPTER II

DESIGN AND PROCEDURE

After initial personality testing, a smaller group of subjects was selected for perceptual testing. In this section, selection of subjects and all instruments are described. The chapter is concluded with an outline of the statistical design.

Subjects

Early in 1965, the Sixteen Personality Factor Questionnaire was administered to seven classes of students taking the introductory course in Educational Psychology at the University of Alberta in Edmonton. Participation was voluntary and students not wishing to take part were allowed to leave the room or read quietly. Only three students refused to complete the questionnaire. Completed tests were obtained from 277 students, 174 females and 103 males. All tests were scored for the second-order factors of Anxiety and Introversion-Extraversion.

Eighty subjects were administered the perceptual tests, ten representing each of the following categories: High Anxiety Females (HAF); Low Anxiety Females (LAF); High Introversion-Extraversion Females (HIEF); Low Introversion-Extraversion Females (LIEF); High Anxiety Males (HAM); Low Anxiety Males (LAM); High Introversion-Extraversion Males (HIEM); and Low Introversion-Extraversion Males (LIEM). High Introversion-Extraversion scores represented

the Introversion end of the scale.

Each of the 80 had an extreme score on one of the two personality factors (Anxiety or Introversion-Extraversion) and a middle score on the other factor. For this purpose it was necessary to establish cutting points dividing each array of scores into three segments: high, middle and low. The same cutting points were used for both men and women, although women's distributions were slightly higher than men's on both factors. These cutting points were established empirically to be as distant as possible from the mean, thus allowing only the minimum needed subjects to have scores more extreme than these boundary scores. Summary data before selection are presented in Table I and after selection in Table II. The means of extreme groups on a single scale, for example High Anxiety Males and Low Anxiety Males, were in every case more than three standard deviations apart.

In order to maintain relative homogeneity with respect to age, two subjects who qualified for perceptual testing on the basis of personality factor scores were over 35 years of age and therefore not used. Age data are reported in the Appendix.

All subjects were asked during the testing session if they had any knowledge of being color blind. The one subject who replied affirmatively was eliminated.

All but two of the subjects contacted by telephone appeared at the examiner's office for perceptual testing. In the office they were seated before the Size Estimation apparatus. The Embedded Figures Test

TABLE I

SUMMARY OF PERSONALITY DATA BEFORE SELECTION FOR PERCEPTUAL TESTING*

Factor and Sex	N	Mean	Standard Deviation	Median
Anxiety Factor Males	103	49.33	13.12	49.00
Anxiety Factor Females	174	53.77	12.60	53.50
Intro-Extra Factor Males	103	43.74	10.56	43.00
Intro-Extra Factor Females	174	45.41	9.79	46.50

* All numbers represent raw scores on the Sixteen Personality Factor Questionnaire.

TABLE II

SUMMARY OF PERSONALITY DATA AFTER SELECTION FOR PERCEPTUAL TESTING *

Group	N	$\bar{X}$ Anxiety Score	Range	$\bar{X}$ Intro-Extra Score	Range
HAF	10	75.5	(67 -)	46.1	(35 - 52)
HAM	10	70.1	(67 -)	42.4	(35 - 52)
LAF	10	33.5	(- 40)	43.8	(35 - 52)
LAM	10	32.3	(- 40)	41.8	(35 - 52)
HIEF	10	51.9	(41 - 66)	59.8	(53 -)
HIEM	10	54.2	(41 - 66)	60.5	(53 -)
LIEF	10	52.6	(41 - 66)	29.5	(- 34)
LIEM	10	51.6	(41 - 66)	27.3	(- 34)

* All numbers are raw factor scores.

followed and at the end of the session all scores were interpreted to the subject. Before leaving, subjects were asked not to tell others about the testing procedure. The personality category of each subject was unknown to the examiner at the time of testing.

With the exception of eight subjects, each student was tested individually by the writer. These eight were tested, also individually, by an assistant. The assistant's testing was distributed evenly, one subject in each category, so as to control for effects he might have had on the subject's performance.

Assessments

Cattell's Sixteen Personality Factor Questionnaire

Raw scores on the "16 P. F. Test" were converted to Sten Scores using Cattell's conversion tables and weighted by the appropriate formula* for second-order factor scores.

Only Form A of this instrument was used. It contains 187, three-choice items. According to Cattell, split-half reliabilities of the five factor scales contributing to the Anxiety dimension range from .76 to .93. Reliabilities of the five scales making up the Introversion-Extraversion dimension range from .79 to .90. Correlations of .67 and .65 with Eysenck's test factors have been reported.

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*These formulae have undergone moderate revisions in a later edition of the manual (Cattell and Eber, 1957, with 1964 supplementation). This revision was unavailable at the time the present study was undertaken.

Size Estimation Test

The Size Estimation apparatus used to obtain a measure of Scanning in the present research was designed and constructed by the writer to closely approximate that used by Gardner in his studies. A description of one commonly used apparatus is given in Gardner, et. al. (1959, p. 48).

The procedure for estimating size entails presenting the subject with two stimuli. One of these, the variable stimulus, is a spot of light that may be changed in size. The size of the other, standard stimulus, remains fixed. The subject controls the size of the variable stimulus in an attempt to match its size with that of the standard.

In the present investigation, the subjects sat facing a 4½ inch, square glass screen. A chin rest was provided at a distance of 18 inches from the screen. Knobs, 3½ inches in diameter, allowed the subject to control the size of the variable stimulus with either his left or right hand.

This arrangement differed from that employed by Gardner in two respects: 1) The stimulus objects, both variable and standard, were square rather than round in shape. Two v-shaped cutouts sliding behind the glass screen permitted sharp definition of the variable stimulus without the complex arrangement of lenses required to produce a variable round stimulus with equally sharp edges. 2) The standard stimulus was placed to the left of the screen in a stationary position.

This was thought to be intermediate between two procedures used by Gardner. In one of these the subject holds the standard stimulus in his hand. In the other, the two stimuli are aligned on a single midline. The present procedure has in common with the first of these placing the two stimuli in different planes and shares with the second the mounting of the standard away from the subject's hand.

Specifically, the standard stimulus was placed on the subject's left and tilted directly toward his eyes at a distance of 20 inches. To the writer's knowledge, there is no evidence that relative positions of standard and variable stimuli affect size estimations. Small overestimations occur regardless of position.

Illumination was provided by reflected light from two, incandescent, 40 watt bulbs placed behind the glass. The surface of the stimulus appeared uniform in illumination and edge definition was excellent. The variable stimulus could be changed in size from 0 to 100 millimeters.

Each of three standard stimuli were judged four times. Starting sizes of the variable stimulus required that the subject make the stimulus smaller twice and then larger twice. This order of descending and ascending trials follows that used by Gardner.

Standard stimuli were black or white squares attached to background plates measuring 4¼ inches (also square). These three standards were a) a 45 mm. white square on a black background plate, b) a 50 mm. white square on a neutral grey plate, and c) a 55 mm.

black square on a white plate.

The order of presentation was randomized. Since there are six possible orders of presentation (abc, acb, bac, bca, cab, cba), each order was assigned a number from 1 to 6 and each subject was assigned a random number in the same range. Matching the random number with an order number determined the order of presentation for any individual subject. Random numbers were selected so as to present each order an equal number of times. Thus, any effects due to order of presentation were eliminated.

Subjects were seated in a chair adjusted to a height which gave them an eye-level view of the variable stimulus. The instructions were as follows:

> "You will notice that by turning this knob (indicated) forward, this patch of light (indicated) becomes larger. By turning it toward you, it becomes smaller. Your job is to adjust the size of the lighted square until it matches this (small white) square in size. You may either use this upright bar as a chin rest or keep your head anywhere behind it. Unless you have any questions you may begin now and tell me when you think the two squares are matched in size."

After one judgement was made, the size was recorded and the subject was told: "Would you now slowly make the square larger until I tell you to stop". When the subject enlarged the square to the next starting position, he was asked to match the stimuli again. Judgements were made for each stimulus beginning at 80, 75, 20 and 25 mm. No time limit was imposed and the entire procedure required ten to fifteen minutes for the twelve judgements. Each subject was scored for average error (mean difference from size of standard).

Reliabilities of Size Estimation errors are reported by Gardner, et. al. (1959). With 30 subjects each making twelve judgements, he found odd-even reliabilities of .95 for men and .92 for women. Errors loaded -.59 on the Scanning factor. High factor scores are associated with limited Scanning.

Embedded Figures Test (EFT)

This test, representing Gardner's Field-Articulation factor, was obtained from H. A. Witkin and administered according to his instructions (Witkin, 1950). The test contains 24 complex designs and 8 simple figures. One of the simple figures is contained within each of the 24 complex designs.

Witkin added color to twenty-three of the designs to make them more difficult. Instructions were given to each subject as suggested by Witkin:

> "I am going to show you a series of colored designs. Each time I show you one of these designs, I want you to describe the overall pattern that you see in it. After examining each design, I will show you a simpler figure which is contained in that larger design. You will then be given the larger design again, and your job will be to locate the smaller figure in it. Let us go through one to show you how it's done."

The subject was then shown a practice design for 15 seconds. This was removed and he was shown the simple figure for 10 seconds. Then he was given the complex figure again, and a stylus, and asked to trace the simple figure. If he traced it correctly, he was told:

> "This is how we will proceed on all trials. I would like to add that in every case the smaller figure will be present in the larger design. It will always be in the upright position.

> There may be several of the smaller figures in the same large design, but you are to look only for the one in the upright position. Work as quickly as you possibly can, since I will be timing you, but be sure that the figure you find is exactly the same as the original figure, both in size and proportions. As soon as you have found the figure, tell me at once. If you ever forget what the small figure looks like you may ask to see it again. Are there any questions?"

The subject's score for the Embedded Figures Test was the total number of seconds to find the simple figures on all of the 24 trials. Thus a higher score represented a slower performance than a lower score. Administration time varied between 30 and 90 minutes.

Gardner, et. al. (1959) administered the EFT to 30 men and 30 women. He reported reliabilities of .92 for men and .95 for women.

Finally, additional analyses were performed on partial EFT scores. Item analyses performed by Gardner, et. al. (1959, pp. 74-75) revealed two major clusters of intercorrelated items. They were labeled Cluster I and Cluster II.

Cluster I contains the following eight items: A-3, C-1, C-2, C-4, C-5, D-2, F-1 and G-1. According to Gardner, et. al., these are relatively easy items and the embedded designs are easily perceived.

Cluster II also contains eight items: A-1, A-4, A-5, E-1, E-2, E-3, E-4 and E-5. These are thought by Gardner to "defy direct perception" because they contain or seem to contain alternative correct solutions. Thus, subjects must "figure out" where the simple figures are contained and trace them line by line. Since these more difficult items contributed more to the total test score, Gardner, et. al. thought that perhaps they would be more highly related to personality

variables than the items in Cluster I.

Since clusters suggest the possibility of heterogeneity, additional analyses were performed to determine the relative relationships of cluster scores to the personality dimensions.

Odd-even reliabilities reported by Gardner, et. al. (1959) for Cluster I were .68 for men and .78 for women. Reliabilities for Cluster II were .87 for men and .88 for women. Because the clusters correlated higher than total test scores with other perceptual measures, these researchers used only cluster scores in their factor analysis. Clusters I and II correlated, respectively, .90 and .89 with total test scores and loaded .81 and .84 on the Field-Articulation factor.

Consonant with earlier data collected by both Witkin's and Gardner's research teams, scores on the EFT were characterized by extreme variability. In order to prevent excessive weighting by extreme scorers and creating more uniform ranges of scores within each cell, item scores were transformed into logarithms. Winer (1962, pp. 218-222) discusses how logarithmic transformations may accomplish these purposes for the Analysis of Variance. This conversion procedure follows that adopted by Gardner in all of his studies employing the EFT, including the factor analytic study (Gardner, et. al., 1959) which initially identified the perceptual factors. All reliabilities reported here are for transformed scores.

Statistical Design

The hypotheses were tested by two-by-two Analyses of Variance. Figure 1. depicts the design and lists all independent and dependent variables. Sex was an independent variable in every analysis. Either Anxiety or Introversion-Extraversion was the other independent variable.

Testing all of the hypotheses called for eight analyses. Four were performed with Sex and Anxiety as independent variables. The other four had Sex and Introversion-Extraversion as independent variables. EFT total scores, EFT Cluster I scores, EFT Cluster II scores, and Size-Estimation errors each served as a dependent variable in two separate analyses, one with each personality dimension.

Dependent Variables

1) EFT Total Scores
2) EFT Cluster I Scores
3) EFT Cluster II Scores
4) Size Estimation Errors

	High Anxiety	Low Anxiety
Male		
Female		

Independent Variables

1) Sex
2) Anxiety Factor Scores
3) Introversion-Extraversion Factor Scores

	High Intro-Extra	Low Intro-Extra
Male		
Female		

FIGURE 1

STATISTICAL DESIGN OF THE STUDY

CHAPTER III

RESULTS

Independence of Assessments

Orthogonality of personality dimensions and of perceptual dimensions are important bases of the present research and suggest an examination of the relationships between the tests representing each pair of factors. In the original sample of 277 students administered the personality questionnaires, correlations between Anxiety and Introversion-Extraversion factor scores were found to be .132 for males and .188 for females. The very small amount of variance represented by these figures is considered to satisfy the expected independence of Anxiety and Introversion-Extraversion factors.

Correlations between the perceptual indices, Size Estimation errors representing Scanning and the Embedded Figures Test total scores representing Field Articulation, were .082 for males and .375 for females. The corresponding correlations found in Gardner's samples were .42 for males and .30 for females. The small size of these figures would indicate that they are relatively independent representatives of their respective factors.

The Embedded Figures Test

Table III summarizes the Analysis of Variance and Table IV reports the cell means and totals for the EFT total scores with the

Anxiety groups. Table V presents a summary of the Analysis of Variance and Table VI gives cell means and totals for the EFT total scores with the Introversion-Extraversion groups. Neither main effects nor interaction effects was significant at or below the .05 level of probability. Thus the EFT total scores failed to distinguish between any of the experimental groups. Hartley's F-maximum test indicated that the assumption of homogeneity of variance was satisfied for these analyses.

Tables VII through XIV summarize the Analyses of Variance, and cell means and totals, for EFT Clusters I and II with both personality groups. No significant findings were obtained. The assumption of homogeneity of variance was satisfied according to Hartley's F-maximum tests performed with each set of data.

Size Estimation Test

The results of the Analysis of Variance for the Size Estimation error scores with the Introversion-Extraversion groups are reported in Table XV; all means and totals are reported in Table XVI. The assumption of homogeneity was met and no significant results were obtained.

The Size Estimation data collected from the Anxiety groups failed to satisfy the assumption of homogeneity according to the results of Hartley's F-maximum test ($F=11.3086$, $p < .005$, $df=1/36$). However, it is recognized that the Analysis of Variance is a hardy test with respect

to its mathematical assumptions. As Edwards (1963) has stated:

> "There is considerable evidence to indicate that in the common case in experimental work where the number of observations is the same for the various treatments, the F test for the means in the analysis of variance is little influenced by heterogeneity of variance. As Box...has emphasized, since the F test is very insensitive to nonnormality and since with equal n's it is also insensitive to various inequalities, it would be best to accept the fact that it can be used safely under most conditions. The F test of the analysis of variance, in other words, remains a robust test under a variety of violations of the assumptions on which it is mathematically based." (p. 132)

In view of these comments, the results of the analysis is reported in Table XVII and the cell means and totals in Table XVIII. The main effect for Anxiety was significant ($F=7.442$, $p < .01$, $df=1/36$). The difference between means was in a direction to indicate the High Anxiety subjects made smaller errors (smaller overestimations) than Low Anxiety subjects.

Edwards suggests correcting for the effects of heterogeneity of variance in a t-test by using one-half of the usual degrees of freedom. A two-tailed t-test thus performed with the Anxiety groups' scores is also significant ($t=2.798$, $p < .01$, $df=19$)

Difference in variability between Anxiety groups was tested. This yielded a significant value ($F=5.796$, $p < .05$, $df=1/36$) indicating that Low Anxiety subjects were more variable in their Size Estimation errors than were the High Anxiety subjects.

Summary of Results

The Embedded Figures Test did not distinguish between the perceptual performances of any of the personality groups. Only the

comparison of High Anxiety subjects with Low Anxiety subjects on Size Estimation errors was significant. High Anxiety subjects made smaller errors. Although this data could not meet the criterion of homogeneity of variance, a two-tailed t-test with half the degrees of freedom was significant and supported the original analysis. Responses of Low Anxiety subjects were significantly more variable than those of High Anxiety subjects.

TABLE III

ANALYSIS OF VARIANCE FOR THE EMBEDDED FIGURES TEST: ANXIETY AND SEX

Source	df	MS	F	p
Anxiety	1	1.9575	.054	n.s.
Sex	1	66.5656	1.836	n.s.
S x A	1	95.5094	2.634	n.s.
Within	36	36.2602		

TABLE IV

CELL MEANS AND TOTALS FOR THE EMBEDDED FIGURES TEST: ANXIETY AND SEX

	Males	Females	Total
High Anxiety	27.7810	27.2706	27.5258
Low Anxiety	24.2481	29.9186	27.0834
Total	26.0146	28.5946	27.3046

TABLE V

ANALYSIS OF VARIANCE FOR THE EMBEDDED FIGURES TEST: INTROVERSION-EXTRAVERSION AND SEX

Source	df	MS	F	p
Intro-Extra	1	24.4865	.533	n.s.
Sex	1	35.1711	.766	n.s.
I-E x S	1	2.1455	.047	n.s.
Within	36	45.9017		

TABLE VI

CELL MEANS AND TOTALS FOR THE EMBEDDED FIGURES TEST: INTROVERSION-EXTRAVERSION AND SEX

	Males	Females	Total
Introverts	29.2243	31.5629	30.3936
Extraverts	28.1227	29.5349	28.8288
Total	28.6735	30.5489	29.6112

TABLE VII

ANALYSIS OF VARIANCE FOR CLUSTER I OF THE EMBEDDED FIGURES TEST: ANXIETY AND SEX

Source	df	MS	F	p
Anxiety	1	2.6953	.565	n.s.
Sex	1	7.4221	1.556	n.s.
A x S	1	11.0152	2.309	n.s.
Within	36	4.7711		

TABLE VIII

CELL MEANS AND TOTALS FOR CLUSTER I OF THE EMBEDDED FIGURES TEST: ANXIETY AND SEX

	Males	Females	Total
High Anxiety	7.6976	7.5096	7.6036
Low Anxiety	6.1289	8.0400	7.0845
Total	6.9133	7.7748	7.3441

TABLE IX

ANALYSIS OF VARIANCE FOR CLUSTER II OF THE EMBEDDED FIGURES TEST: ANXIETY AND SEX

Source	df	MS	F	p
Anxiety	1	3.8510	.675	n.s.
Sex	1	1.3293	.233	n.s.
A x S	1	15.0499	2.638	n.s.
Within	36	5.7045		

TABLE X

CELL MEANS AND TOTALS FOR CLUSTER II OF THE EMBEDDED FIGURES TEST: ANXIETY AND SEX

	Males	Females	Total
High Anxiety	9.0780	8.2157	8.6469
Low Anxiety	7.2306	8.8220	8.0263
Total	8.1543	8.5189	8.3366

TABLE XI

ANALYSIS OF VARIANCE FOR CLUSTER I OF THE EMBEDDED FIGURES TEST: INTROVERSION-EXTRAVERSION AND SEX

Source	df	MS	F	p
Intro-Extra	1	1.5044	.198	n.s.
Sex	1	.0755	.010	n.s.
I-E x S	1	.0174	.002	n.s.
Within	36	7.5903		

TABLE XII

CELL MEANS AND TOTALS FOR CLUSTER I OF THE EMBEDDED FIGURES TEST: INTROVERSION-EXTRAVERSION AND SEX

	Males	Females	Total
Introverts	8.1328	8.0906	8.1117
Extraverts	7.7900	7.6584	7.7242
Total	7.9614	7.8745	7.9180

TABLE XIII

ANALYSIS OF VARIANCE FOR CLUSTER II OF THE EMBEDDED FIGURES TEST: INTROVERSION-EXTRAVERSION AND SEX

Source	df	MS	F	p
Intro-Extra	1	.7815	.117	n.s.
Sex	1	11.6947	1.754	n.s.
I-E x S	1	1.1317	.170	n.s.
Within	36	6.6677		

TABLE XIV

CELL MEANS AND TOTALS FOR CLUSTER II OF THE EMBEDDED FIGURES TEST: INTROVERSION-EXTRAVERSION AND SEX

	Males	Females	Total
Introverts	9.1297	10.5475	9.8386
Extraverts	9.1865	9.9316	9.5591
Total	9.1581	10.2396	9.6989

TABLE XV

ANALYSIS OF VARIANCE FOR THE SIZE ESTIMATION ERRORS: INTROVERSION-EXTRAVERSION AND SEX

Source	df	MS	F	p
Intro-Extra	1	1.3738	.392	n.s.
Sex	1	.7798	.222	n.s.
I-E x S	1	.5251	.150	n.s.
Within	36	3.5087		

TABLE XVI

CELL MEANS AND TOTALS FOR THE SIZE ESTIMATION ERRORS: INTROVERSION-EXTRAVERSION AND SEX

	Males	Females	Total
Introverts	3.0668	2.5584	2.8126
Extraverts	2.3428	1.7087	3.1833
Total	3.1376	2.8583	2.9980

TABLE XVII

ANALYSIS OF VARIANCE FOR THE SIZE ESTIMATION ERRORS: ANXIETY AND SEX

Source	df	MS	F	p
Anxiety	1	18.7936	7.442	<.01
Sex	1	1.7024	.674	n.s.
A x S	1	3.1630	1.253	n.s.
Within	36	2.5252		

TABLE XVIII

CELL MEANS AND TOTALS FOR THE SIZE ESTIMATION ERRORS: ANXIETY AND SEX

	Males	Females	Total
High Anxiety	2.0582	1.9084	1.9833
Low Anxiety	2.8662	3.8417	3.3540
Total	2.4622	2.8751	2.6687

CHAPTER IV

DISCUSSION AND SUMMARY

The purpose of this study was to investigate the possible relationships between orthogonal factors emerging from responses to personality inventories and orthogonal factors obtained from performance scores on perceptual tests. Studies have been reviewed (Eysenck, 1960; Kassebaum, et. al., 1959; Welsh, 1956) which have shown "General Maladjustment" and "Introversion-Extraversion" to consistently emerge as independent personality dimensions. Scanning and Field Articulation, the orthogonal perceptual dimensions studied here, rest heavily on research by Gardner, et. al. (1959) for interpretation.

Second-order factor scores on Cattell's Sixteen Personality Factor Questionnaire served to select subjects representing each end of both personality continua. Thus, using Cattell's terminology, subjects were selected for High Anxiety, Low Anxiety, High Introversion-Extraversion and Low Introversion-Extraversion. To test the perception-personality relationships with both sexes, eight groups of subjects were required, one of each sex from each personality category. All of the subjects selected on the basis of the personality inventory were administered tests loading high on the perceptual factors.

The first of these factors, Scanning, appears to represent the extent to which an individual samples available stimuli. Thus an extensive Scanner, on a visual task, looks at and sees more in his

immediate surrounds. The extent of Scanning was assessed by a test of Size Estimation. Former work has shown that on this test, virtually everyone will overestimate a standard or criterion stimulus but extensive Scanning is associated with relatively smaller overestimations and limited Scanning with larger overestimations.

Field Articulation, represented by the Embedded Figures Test in this work, is a perceptual factor interpreted as the ability to differentiate and relate components of the stimulus field. Therefore, a high Field Articulator is better equipped to sort the relevant from irrelevant information and make a lower score on the EFT.

Earlier research has demonstrated a relationship between Introversion and tests loading on Gardner's Scanning factor (Ardis and Fraser, 1957; Thouless, 1932; and Weber, 1939); other research has shown Anxiety to be related to performance on a test which loads on the Field Articulation factor (Weiss and Sherman, 1961). However, the perceptual tests employed in these studies have not been those which best represented their respective factors in terms of high factor loadings. In order to investigate the overlap of these perceptual factors with the orthogonal personality factors, the following hypotheses were formulated:

1) Subjects with High Anxiety factor scores will have longer response times (make higher scores) than Ss with Low Anxiety factor scores to items on the Embedded Figures Test.

2) Subjects with High Introversion-Extraversion factor scores will make

larger errors than Ss with low factor scores on a test of Size Estimation.

Since high EFT scores represent high loadings on the Field Articulation factor, it was predicted that this would correspond to high Anxiety factor scores. Similarly, since larger overestimations represent high Scanning factor loadings, this was expected to correspond to high Introversion-Extraversion factor scores (the Introversion end of the continuum).

The results of two analyses of variance, one testing the correspondence of Introversion-Extraversion to Scanning and the other testing Anxiety and Field Articulation, were negative and the hypotheses were not supported. There is, then, no evidence in the present research supporting the overlap of the two pairs of factors in the direction hypothesized.

When factors represented by perceptual tests are considered, the present findings are discrepant with those of other studies. That is, the present study did not confirm the results of Ardis and Fraser, (1957), Thouless (1932) and Weber (1939) pointing to a relationship between Introversion-Extraversion and tests loading on the Scanning factor; and it failed to support the finding of Weiss and Sherman (1961) that Anxiety was related to a test loading on the Field Articulation factor. Several reasons for these differences in results are suggested.

First, it is recognized that this study made use of different assessments. The selection of perceptual tests (Size Estimation and

the Embedded Figures Test) was guided by the suggestions of Gardner, et. al. (1959) that these were the best representatives of their respective factors. Although the perceptual measures used by the other authors (Perceptual Constancy and Stroops Color-Word Test) loaded on the same factors, they cannot be assumed to be equivalent representatives of those factors. Similarly, the different measures of Anxiety and Introversion-Extraversion may account for some of the difference in findings. In other words, although the earlier work suggested the factor relationships here hypothesized, the negative results of this study suggest that the personality-perception relationships may be specific to certain tests.

Secondly, it is noted that whenever relationships between personality and perception are reported in terms of correlations, the size of these figures does not account for a large portion of the variance. Weiss and Sherman (1961) found that the Stroops Color-Word Test correlated .25 with Anxiety. Correlations of the EFT with personality scores derived from tests of a perceptual type, such as the Rorschach or Figure Drawings, ranged to somewhat higher levels; when personality scores were derived from inventories and interviews, correlations were smaller. The EFT, in the study by Gardner, et. al. (1959), correlated between .12 and .56 with various Rorschach scores. Gruen (1955) found correlations between .37 and .68 with Rorschach scores and between .28 and .63 with indices from Figure Drawings. In the same study, Gruen reported a lower range of coefficients (.33 to .47)

with interview data. A correlation of -.40 was found by Wertheim and Mednick (1958) between the EFT and need achievement. Many of these coefficients are significant statistically and suggest some correspondence of personality and perception. Nevertheless, in terms of the variance accounted for, the overlap is small. For example, the Stroops (loading on the Field-Articulation factor) and Anxiety shared less than ten percent of the variance. From this point of view, the difference between present and former findings is not large.

Further, in a sense this study attempted to replicate earlier findings of other investigators. The fact that a different group of subjects from a different population was used here may have contributed to the difference in findings.

Had the two pair of orthogonal factors been found to overlap, the independence of the resulting dimensions could have been demonstrated by support of the following hypotheses:

3) There will be no significant difference between Anxiety groups on the Size Estimation Test.

4) There will be no significant difference between Introversion-Extraversion groups on the Embedded Figures Test.

However, an analysis of variance showed the mean error of High Anxiety subjects to be significantly smaller than the mean error of Low Anxiety subjects on the Size Estimation Test. This is additional evidence that the personality and perception factors do not overlap as hypothesized.

If we accept that the size of errors is associated with Scanning, we can consider the High Anxiety subjects relatively extensive Scanners and the Low Anxiety subjects relatively limited Scanners. Gardner and Long (1962b) attempted to describe the approach of extensive and limited Scanners to the task of estimating size.

> "The extensive scanner seems preoccupied with the veridicality, exactness and acceptability of his response. The limited scanner seems to accept his perceptual experience in a more relaxed and less critical way." (p. 139)

If we further accept "exactness" as a manifestation of High Anxiety and "relaxed and less critical" as characteristic of Low Anxiety, the present study would appear to support the observations of these authors. However, the added finding that High Anxiety groups were characterized by less variability suggests that the description more uniformly applies to these individuals than to those in the Low Anxiety groups. Differences in variability may warrant further research.

Interestingly, although Scanning and Anxiety were positively related in the present study, we find in Cattell's manual that a personality description of High Anxiety individuals is in part at variance with the above picture of the extensive Scanner's more precise approach to perceptual tasks (the same individuals in the present study). Factor "Q3", describing high scorers as "controlled", "socially precise, self-disciplined, compulsive" and having "exacting will power", loads _negatively_ on the second-order Anxiety factor. Thus, it appears that the subjects' social orientation is at odds with their orientation to non-social or object perceptions. Precision and exactness characterized

their approach to estimating size but the absence of these qualities as general personality traits contributed to their selection as High Anxiety subjects. High social precision and exactness associated with low precision of object perception raises interesting questions.

Research reported by Gardner's team has been concerned with non-social perceptual tasks. Cattell's scale is generally socially oriented. He sees the precision represented by factor "Q3" as reflecting a well integrated self-concept and a well crystallized pattern of socially approved behavior. If this kind of person is at the same time more lax in his general perceptual performance, as the present findings suggest, other research might focus on social perceptions or even physical perceptions of social objects to determine if social and object perceptions can be described in the same terms. Perhaps, for example, the individual who is socially precise and who, in this research, was perceptually imprecise, is very exact in his perception of facial expressions, tones of voice, and so forth. It may not be correct to consider all classes of an individual's perception as having the same characteristics or to make inferences about the perception of one class of stimuli based on perception of other classes of stimuli.

That there were no sex differences in performance on the Embedded Figures Test was not only contrary to expectations (Hypothesis 5) but at variance with all known studies using this test with both sexes (e.g. Witkin, 1950 and Bieri, Bradburn and Galinsky, 1958). Earlier data were, of course, gathered from a more random sampling of individuals

than in the present research, so there exists the possibility that by selecting extreme personality groups, sex differences were obscured or eliminated. Testing different subjects from a different country (Canada) may have also contributed to the discrepant findings. To this writer's knowledge, the Embedded Figures Test has never been administered to a group of Canadians before. Only additional studies with subjects representing personality extremes and additional Canadian data will clarify these issues.

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APPENDIX: RAW DATA

HIGH ANXIETY FEMALES

Subject Number	Age	Anxiety Factor Score	Introversion-Extraversion Score	EFT Log Total	EFT Log Cluster I	EFT Log Cluster II	Size Estimation Error
1	18	70	38	31.3413	9.3966	10.3712	2.250
2	21	83	42	19.3284	4.7938	6.0667	1.667
3	17	78	42	20.4487	5.2919	5.3130	1.583
4	18	77	43	30.5125	7.0712	11.1862	1.250
5	19	68	47	17.6085	4.7358	5.3679	2.417
6	18	78	48	27.3883	7.7347	8.3825	.917
7	20	71	49	30.1738	8.1943	7.6163	1.917
8	18	80	50	28.4076	7.6407	8.0966	3.250
9	18	80	50	36.2268	9.8742	10.8414	2.333
10	19	70	52	31.2699	10.3628	8.9154	1.500
Mean	18.6	75.5	46.1	27.2706	7.5096	8.2157	1.908
S.D.	1.114			5.7964	1.9496	2.0593	.641

HIGH ANXIETY MALES

Subject Number	Age	Anxiety Factor Score	Introversion-Extraversion Score	EFT Log Total	EFT Log Cluster I	EFT Log Cluster II	Size Estimation Error
11	17	68	50	22.4907	4.5042	8.1334	1.250
12	18	70	36	22.2601	6.6900	5.7516	2.333
13	18	72	36	35.2023	10.2292	10.8460	1.833
14	18	70	37	21.0509	3.6053	5.9857	1.750
15	22	71	39	27.6367	8.0892	10.2473	2.583
16	20	73	39	25.2425	8.0692	8.0662	1.083
17	19	68	41	34.9999	9.1307	12.7073	1.167
18	20	72	47	29.3822	8.0646	9.0294	1.083
19	19	67	50	31.2302	10.3223	10.0672	4.000
20	18	70	49	28.3146	8.2715	9.9456	3.500
Mean	18.9	70.1	42.4	27.7810	7.6976	9.0780	2.058
S.D.	1.375			4.8184	2.0992	2.0480	.985

LOW ANXIETY FEMALES

Subject Number	Age	Anxiety Factor Score	Introversion-Extraversion Score	EFT Log Total	EFT Log Cluster I	EFT Log Cluster II	Size Estimation Error
21	19	37	52	24.0019	6.0617	6.4270	2.000
22	18	40	38	35.0638	8.2566	12.9612	6.917
23	19	29	38	25.5434	6.1457	8.4303	2.000
24	20	31	39	20.8074	3.6512	5.0765	1.000
25	18	38	40	30.3874	8.4879	9.3112	3.167
26	18	38	41	37.2421	11.6033	10.0169	7.250
27	18	31	45	38.2570	9.9897	13.2844	1.833
28	18	36	48	23.8820	6.3469	5.9455	5.750
29	21	30	48	29.4168	9.0291	7.1161	3.250
30	20	25	49	34.5843	10.8276	9.6504	5.250
Mean	18.9	33.5	43.8	29.9186	8.0400	8.8220	3.842
S.D.	1.044			5.8778	2.3479	2.6552	2.154

LOW ANXIETY MALES

Subject Number	Age	Anxiety Factor Score	Introversion-Extraversion Score	EFT Log Total	EFT Log Cluster I	EFT Log Cluster II	Size Estimation Error
31	21	37	35	34.1728	8.2108	11.1920	.750
32	20	31	36	25.6353	7.6789	7.2744	1.750
33	19	31	37	23.8477	5.9714	7.8379	3.500
34	19	35	39	23.8105	6.2948	6.7091	5.833
35	25	25	41	26.5117	8.0603	6.5740	4.417
36	21	37	43	26.9782	4.9857	9.1204	2.667
37	22	32	46	26.3810	6.4685	7.9672	1.167
38	21	28	47	8.5211	1.7159	2.6358	5.500
39	25	35	51	19.7948	4.7109	4.5699	1.500
40	23	32	43	26.8281	7.1920	8.4251	1.583
Mean	21.6	32.3	41.8	24.2481	6.1289	7.2306	2.867
S.D.	2.059			6.2589	1.8590	2.2472	1.752

HIGH INTROVERSION-EXTRAVERSION FEMALES

Subject Number	Age	Anxiety Factor Score	Introversion-Extraversion Factor Score	EFT Log Total	EFT Log Cluster I	EFT Log Cluster II	Size Estimation Error
41	18	53	57	24.1045	4.2369	6.6912	2.417
42	19	49	59	26.7466	7.2289	7.1698	1.500
43	21	51	62	42.0610	11.6119	12.9726	1.917
44	21	53	76	32.9517	7.4089	15.3689	7.000
45	29	54	56	28.6233	6.6327	11.2773	2.333
46	19	55	63	33.5609	8.8943	9.7358	2.750
47	19	56	57	19.5051	4.0157	7.1038	.917
48	19	56	55	34.8217	9.4637	10.9337	3.917
49	19	46	57	37.0842	10.9145	12.0928	2.000
50	19	46	56	36.1696	10.4986	12.1292	.833
Mean	20.3	51.9	59.8	31.5629	8.0906	10.5475	2.558
S.D.	3.035			6.4132	2.5198	2.7110	1.709

HIGH INTROVERSION-EXTRAVERSION MALES

Subject Number	Age	Anxiety Factor Score	Introversion-Extraversion Factor Score	EFT Log Total	EFT Log Cluster I	EFT Log Cluster II	Size Estimation Error
51	34	43	53	27.2696	7.1741	9.3351	.917
52	18	60	58	24.4936	5.8163	7.3486	5.000
53	29	60	68	22.6777	6.3837	6.2153	.667
54	18	58	68	42.7874	13.0249	13.3058	4.167
55	19	58	67	24.0271	7.2677	8.8214	1.667
56	21	57	57	26.2088	8.5841	6.7334	1.833
57	26	44	54	31.2779	8.7132	7.5383	8.667
58	19	54	54	22.2432	3.8115	8.3799	2.583
59	23	53	66	39.0194	12.4768	12.4716	1.167
60	19	55	60	32.2380	8.0758	11.1475	4.000
Mean	22.6	54.2	60.5	29.2243	8.1328	9.1297	3.067
S.D.	5.161			6.6864	2.6854	2.3091	2.343

LOW INTROVERSION-EXTRAVERSION FEMALES

Subject Number	Age	Anxiety Factor Score	Introversion-Extraversion Factor Score	EFT Log Total	EFT Log Cluster I	EFT Log Cluster II	Size Estimation Error
61	19	41	31	29.8167	9.1733	8.9170	1.833
62	19	42	32	36.6195	8.9049	13.3803	.833
63	18	47	29	24.4798	6.5298	7.2835	1.833
64	20	48	33	40.2840	11.2266	13.8454	6.333
65	19	52	32	25.9643	9.1858	7.2160	3.833
66	19	55	34	24.3372	4.4652	8.8979	3.667
67	19	56	34	20.7470	3.3502	7.9338	1.667
68	19	58	15	28.4594	5.8224	9.2144	4.250
69	19	62	28	31.1693	8.7904	12.5599	4.750
70	19	65	27	33.4713	9.1352	10.0673	2.583
Mean	19.0	52.6	29.5	29.5349	7.6584	9.9316	3.158
S.D.	.447			5.7241	2.3617	2.3479	1.612

LOW INTROVERSION-EXTRAVERSION MALES

Subject Number	Age	Anxiety Factor Score	Introversion-Extraversion Factor Score	EFT Log Total	EFT Log Cluster I	EFT Log Cluster II	Size Estimation Error
71	23	47	30	34.2859	10.1918	11.8283	3.333
72	22	48	29	17.3325	4.1320	5.1385	1.833
73	18	52	22	34.2837	10.2935	11.2597	5.583
74	22	51	30	23.8752	7.2377	6.7286	4.250
75	20	54	28	25.6278	5.2377	8.9189	4.417
76	18	56	21	35.5943	10.8120	10.3502	1.000
77	20	57	33	25.2311	4.6355	10.4773	3.667
78	19	62	28	39.4484	12.8610	12.8107	2.417
79	22	47	28	22.6212	6.4525	6.9693	2.583
80	18	42	24	22.9264	6.0458	7.3838	3.000
Mean	20.2	51.6	27.3	28.1227	7.7900	9.1865	3.208
S.D.	1.833			6.8289	2.8612	2.4103	1.274

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